Space Weather Forecast

Issued on Tuesday, 02 January 2024 at 13:23 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate flares likely with a chance of isolated Strong flares. G1/Minor Storms likely day 1 (02 Jan) from glancing arrival of the coronal mass ejection from Dec 31.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with one Moderate flare observed from the active region in the northeast. This remains the main region of note, with three total on the disc. Since the Strong flare on 31 Dec, some ongoing development has been apparent however this region has also been moving to a less oblique viewing angle, with some of this apparent growth likely due to this. The region is relatively small, but with a main spot of two opposite magnetic polarities leading to a complex magnetic structure, visible also in SDO imagery above the spot. The other three spots are smaller, with one declining just west of the southern-centre disc, and a new numbered region to the north of the main spot that is still showing signs of growth. During this period, we have seen a re-emergence of an ex-sunspot region in the southwest, which is difficult to analyse due its viewing angle, with this region due to rotate off disc soon.

No Earth-directed coronal mass ejections (CMEs) were observed in this period.

Solar Wind / Geomagnetic: Solar winds perhaps showed the gradual onset of coronal hole sourced fast winds. Background wind speeds persisted, but with a very gradual and step-wise increasing trend to Slightly Elevated levels, rising from 330 km/s to around 450km/s by the end of the period. Interplanetary Magnetic Field (IMF) has been mostly Moderate. The north-south component was mainly negative (southward), and also varied erratically but with a gradually strengthening trend. Geomagnetic activity increased from Quiet (Kp 0-1) to be Unsettled to Active between 01/1500-02/0300 UTC (Kp3-4).

Energetic Particles / Solar Radiation: Count rate of energetic particles (high energy protons) was mostly at background, though a minor response to the strong flare on 31 Dec was observed and is ongoing but remained below the S1 Minor Radiation Storms level.

Four-Day Space Weather Forecast Summary

Solar Activity: The complex region in the northeast dominates the flare risk during the forecast period. Generally Moderate activity is expected, with chance of further isolated Strong flares.

Solar Wind / Geomagnetic Activity: The fast Strong-flare CME now dominate the solar wind forecast. This has been assessed as passing largely behind Earth, however an impact is possible predominately from its shock. This will likely increase solar wind speeds, perhaps to Elevated or Strong levels (600-750km/s), but with the ejecta largely missing, only a relatively limited geomagnetic response is currently expected. Confidence is low however, due to the source of the CME being close to the east limb. Otherwise, fast wind conditions from a coronal hole are expected to soon arrive at Earth on day 1 (02 Jan), before gradually easing through the

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period. Geomagnetic activity is forecast to become Unsettled to Active with a chance of G1 Minor storms with the fast wind onset. Any CME arrival will bring a chance of Active to G1 Minor Storm intervals and a slight chance of G2 Moderate Storms day 1 (02 Jan). There remains a chance of Active and a slight chance G1 minor storm intervals into day 2 (03 Jan), but otherwise geomagnetic activity easing back towards mainly Quiet with Unsettled intervals from day 3 (04 Jan).

Energetic Particles / Solar Radiation: Count rate of energetic particles (high energy protons) may continue to rise ahead of the expected CME arrival, and from any further notable flares, but likely remaining below S1 Minor Radiation storm levels.

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	60	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X	No	25	25	25	25

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Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	10	10	15
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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